National Institute of Environmental Health Sciences

Meteorological effects on the levels of fecal indicator bacteria in an urban stream: A modeling approach

Author(s): Cho KH, Cha SM, Kang JH, Lee SW, Park Y, Kim JW, Kim JH
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Abstract:

Gwangju Creek (GJC) in Korea, which drains a highly urbanized watershed, has suffered from substantial fecal contamination, thereby limiting the beneficial use of the water in addition to threatening public health. In this study, to quantitatively estimate the sinks and sources of fecal indicator bacteria (FIB) in GJC under varying meteorological conditions, two FIB (i.e., Escherichia coli and enterococci bacteria) were monitored hourly for 24h periods during both wet and dry weather conditions at four sites along GJC, and the collected data was subsequently used to develop a spatiotemporal FIB prediction model. The monitoring data revealed that storm washoff and irradiational die-off by sunlight are the two key processes controlling FIB populations in wet and dry weather, respectively. FIB populations significantly increased during precipitation, with greater concentrations occurring at higher rainfall intensity. During dry weather, FIB populations decreased in the presence of sunlight in daytime but quickly recovered at nighttime due to continuous point-source inputs. In this way, the contributions of the key processes (i.e., irradiational die-off by sunlight, settling, storm washoff, and resuspension) to the FIB levels in GJC under different meteorological conditions were quantitatively estimated using the developed model. The modeling results showed that the die-off by sunlight is the major sink of FIB during the daytime in dry weather with a minor contribution from the settling process. During wet weather, storm washoff and resuspension are equally important processes that are responsible for the substantial increase of FIB populations.

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Resource Description

Early Warning System: ☑

resource focus on systems used to warn populations of high temperatures, extreme weather, or other elements of climate change to prevent harm to health

A focus of content

Exposure : ☑

weather or climate related pathway by which climate change affects health

Extreme Weather Event, Food/Water Quality

Extreme Weather Event: Flooding

Food/Water Quality: Pathogen

Geographic Feature: ☑

resource focuses on specific type of geography

Freshwater, Urban

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Asia

Asian Region/Country: Other Asian Country

Other Asian Country: Korea

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Foodborne/Waterborne Disease

Foodborne/Waterborne Disease: General Foodborne/Waterborne Disease

Model/Methodology: ☑

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Short-Term (

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content